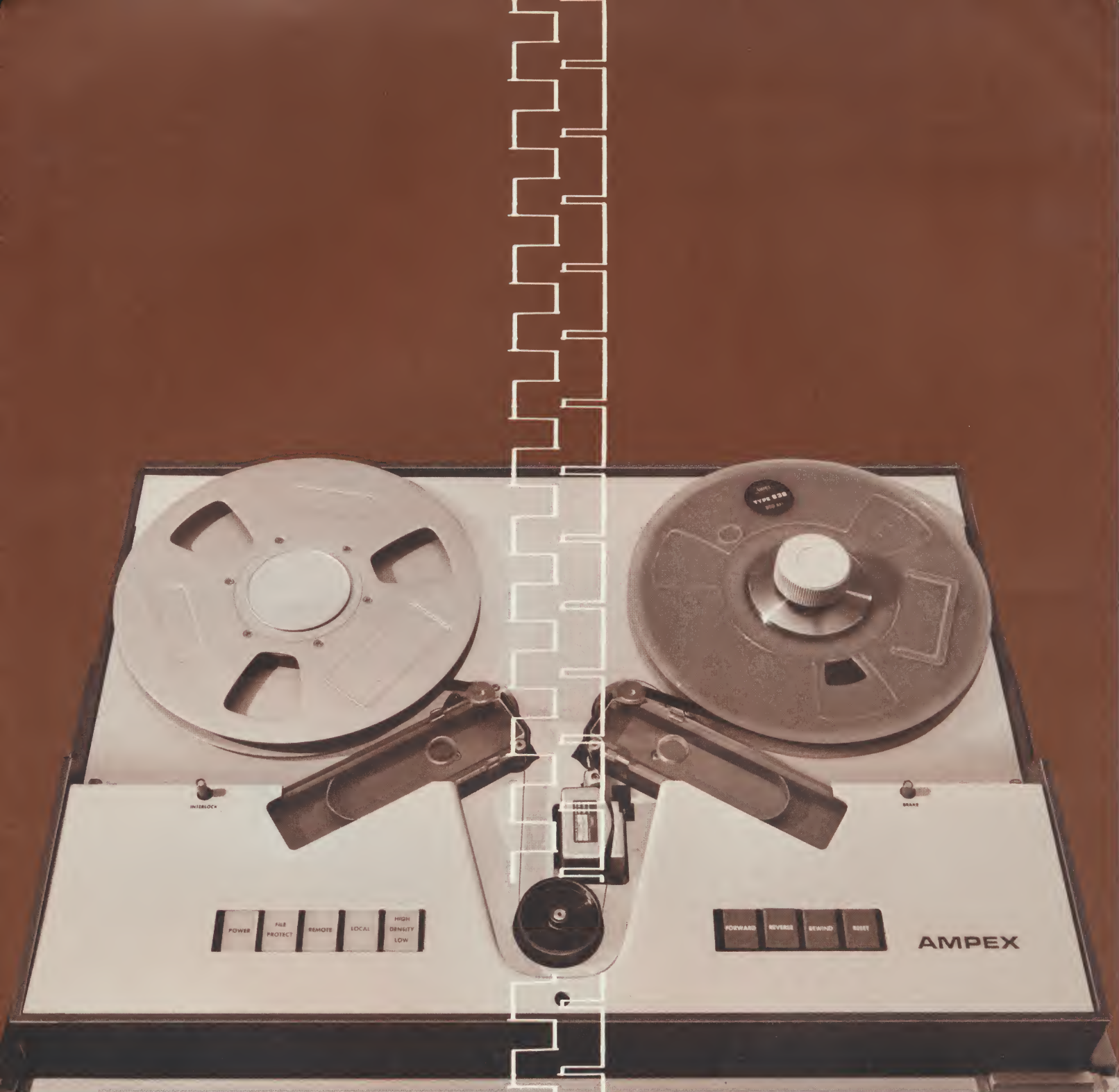




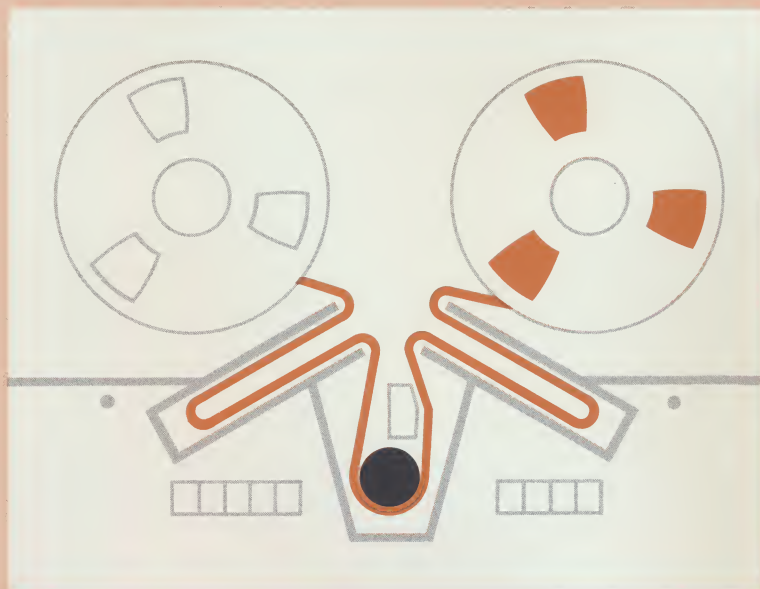
AMPEX

TM-7 DIGITAL TAPE TRANSPORT

TM-7200 TAPE MEMORY SYSTEM

A new and revolutionary single-capstan-drive tape transport with speeds to 45 ips — plus tape memory electronics for writing, reading and checking digital data to 800 bpi.

AMPEX TM-7200



TAPE MEMORY SYSTEMS with new, reliable TM-7 single capstan tape drive

The heart of a digital tape system is the *tape drive*, and the sole function of a tape drive is a simple one: to move tape in a forward or reverse direction at a specified speed, or to keep the tape at a standstill — ready to respond instantly to a command. However, today's sophisticated computing systems require more and more exacting tape drive performance to do these simple tasks. The trend in tape drive design, until the TM-7, has been to complicate the drive mechanism to improve performance. But in the TM-7, an opposite point of view has been taken. Instead of complicating an existing design, an entirely new type of basic digital tape drive was developed.

TM-7 TAPE DRIVE: THE ULTIMATE IN SIMPLICITY

In the new Ampex TM-7 tape drive, a revolutionary straight-forward approach has resulted in a tape drive that approaches the ideal. This all-new design utilizes a single capstan (without pinch rollers) and a low-friction tape path. The tape is held in contact with the capstan at all times by uniform tension derived from vacuum columns. Thus, tape motion over the head directly follows that of the capstan surface regardless of wide changes in friction properties of the tape or mechanism. This single capstan is servo driven to give uniform and closely controlled performances without influences from line voltage or frequency variations.

In the TM-7, there is no "dead time" and no tape velocity overshoot during start/stop transient, allowing the full start/stop time to be utilized for uniform and gentle tape accelerations. Start/stop characteristics and nominal tape velocity can be held within $\pm 8\%$ regardless of normal environment, line voltage or frequency variations. The tape path is comprised of *only* two vacuum storage columns and four guiding elements, *with no* mechanical adjustments required.

ADVANCED DESIGN FEATURES OF THE TM-7 RESULT IN IMPROVED PERFORMANCE

■ Full Restriction-Free Programming

Because of its unique design, the TM-7 has *no program restrictions whatsoever* (at specified data transfer rates).

■ Positive Control of Start/Stop Distance, Time

By use of servo-controlled capstan (plus low-friction tape path), conventional starting and stopping "slippage" is absorbed and controlled within the servo control and magnetic properties of the capstan drive.

■ Maximum Protection of Tapes

The low-tension tape path (with all roller guides), lack of frictions, and absence of devices to grip and pinch tapes on the TM-7 — result in maximum tape protection and greatly increased tape life.

■ Minimal Servicing, No Mechanical Adjustment

Elimination of complex capstan roller assemblies, brakes, adjustable guides, pressure pads, belts, pulleys and solenoids on the TM-7 has eliminated the need for mechanical adjustments, drastically reduced the amount of service required (as compared to other transports).

■ Highly Reliable Tape Loop Sensing

The TM-7 uses simple, non-temperamental, non-critical optical loop sensing.

■ Dropout Errors Reduced

Since very little shed material is produced on the TM-7 (due to the minimal number of surfaces that contact the oxide on a moving tape), dropout errors are drastically reduced. Also contributing to error reduction is the smooth-faced TM-7 read/write head and built-in mechanical tape cleaner.

■ Perfect Rewind Packing Assured

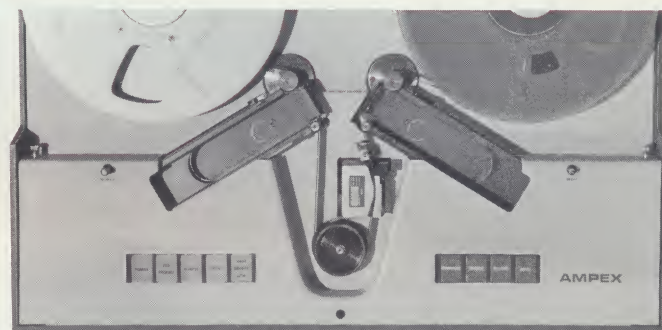
During rewind on the TM-7, tape is not removed from the vacuum chambers. Therefore, an even, constant tension is always applied to the rewinding tape pack.

■ Easy Access to All Major Assemblies

Both the front and rear of the TM-7 are simple and uncomplicated. All components are readily accessible, easy to reach.

TM-7 DRIVE MECHANISM

The tape drive system is located centrally on the transport and consists of a single capstan only. Starting and stopping is accomplished by direct drive control of the single capstan, and the drive system (via a low inertia to high torque motor ratio) is servo controlled to regulate the start/stop distances to within specified distances. This type of drive is completely free from the conventional problems of: simultaneous actuations, permanent tape damage, periodic tape drive adjustments, scheduled replacement of wearing parts, surfaces that cause tape wear. Since tape tension is always equal in either direction during start and stop modes, there is virtually no tape flap over the read/write head. For this reason, a bias (erase) head is not required on the TM-7. Simplification at the highest degree of reliability is the predominant design feature of the TM-7 drive mechanism.



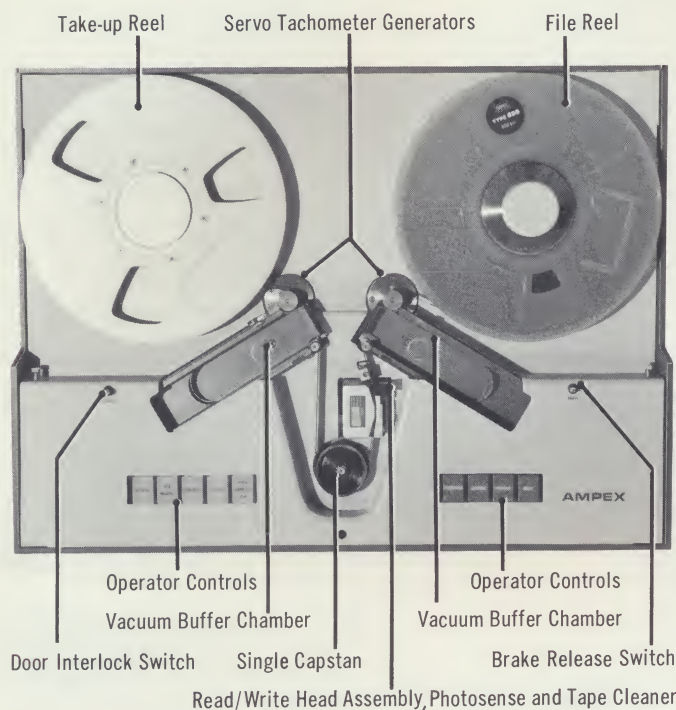
TM-7 TAPE DRIVE

TM-7 STORAGE REEL SERVOS

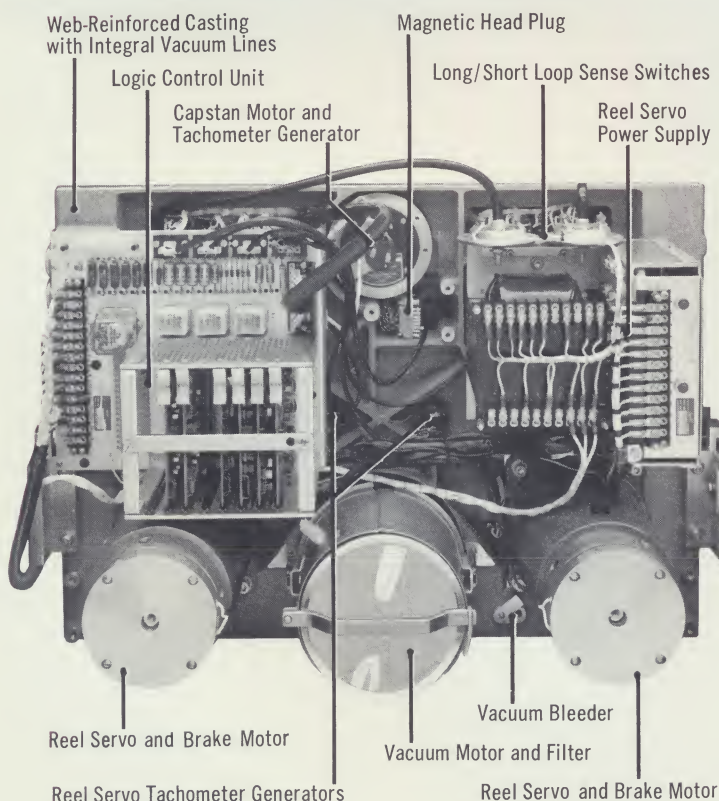
The reel servo on the TM-7 is a tape loop position servo-mechanism with velocity feedback. Two loop position photosense units are displaced equidistant from the center of each chamber. When the tape loop is in between these photo sensors, the loop is in a null position. When the loop is displaced beyond either of these two positions, a signal is generated to apply voltage to the appropriate servo motor to either feed tape into, or move tape from the chamber that is not in a null condition. The tape velocity to and from each reel is measured by a DC tachometer (capstan servo tachometer) and compared with a reference velocity. Thus, the reel servo is at all times given a precise reference of the tape velocity, at either operational or rewind speed. When the transport is in "standby" mode, tape loops fall within the null area and there is no motor heating or jitter. Also, tape pack devices are not necessary on the TM-7 due to the uniform tape tension maintained during rewind.

TM-7 TAPE TRANSPORT PERFORMANCE CHARACTERISTICS

FRONT VIEW — TM-7 TAPE TRANSPORT



REAR VIEW — TM-7 TAPE TRANSPORT



TAPE WIDTH:

1/2 inch tape; compatible with IBM or NARTB type reels.

TAPE SPEEDS:

36 ips, single speed standard; special speeds available to 45 ips maximum.

REWIND SPEED:

2400 feet can be rewound in less than 3 minutes. (During rewind, tape is NOT removed from vacuum chambers.)

START/STOP CHARACTERISTICS:

START TIME	10 milliseconds, maximum
STOP TIME	10 milliseconds, maximum
START DISTANCE	.156" minimum, .234" maximum
STOP DISTANCE	.133" minimum, .195" maximum

TOTAL SPEED VARIATION (TSV = ISV + Long Term Speed Variation):

TSV = 8% or less of operational speed 10 ms after start command.

INTERCHANNEL TIME DISPLACEMENT (ITD):

	PEAK DYNAMIC SKEW	STATIC SKEW	ITD
DUAL R/W STACK	6 μ sec peak-to-peak	$\pm 14 \mu$ sec	20 μ sec
SINGLE STACK (read or write)	3 μ sec peak-to-peak	$\pm 7 \mu$ sec	10 μ sec

SUPPLY VOLTAGE:

Voltage: 100, 110, 115, 125, 200, 210, 215, 220, 230, 235, 240 or 250 volts AC

Frequency: 48 to 63 cps

ENVIRONMENT:

	OPERATING	STORAGE
TEMPERATURE	60° to 90°F	-30° to +150°F
HUMIDITY	40% to 70% *	90% maximum*
ALTITUDE	0 to 7500 ft.	0 to 40,000 ft.

* No Condensation

DIMENSIONS AND WEIGHTS:

	HEIGHT	DEPTH	WIDTH	WEIGHT
Tape Transport	26"	15"	19"	148 lbs.
Front Access Door	26"	1"	19"	20 lbs.

TAPE INTERCHANGEABILITY:

Tapes processed on a TM-7 transport have a suitable pack to permit their use on Ampex TM-3, TM-4 and the IBM 7330 and 729 family.

MOUNTING

The tape transport may be mounted on a standard 19-inch rack or in the TM-7200 series console type cabinets.

TM-7 OPERATOR CONTROL PANEL FUNCTIONS:

POWER SWITCH / INDICATOR	RESET SWITCH
LOCAL SWITCH / INDICATOR	REVERSE SWITCH
REMOTE SWITCH / INDICATOR	REWIND SWITCH
FORWARD SWITCH	FILE PROTECT INDICATOR
HIGH / LOW DENSITY SWITCH / INDICATOR	

AMPEX TM-7200 TAPE MEMORY SYSTEMS

The TM-7200 Series Memories (TM-7211, TM-7212) are complete digital tape memories for use with moderate speed computers — as an on-line or auxiliary tape memory for computer input and output — or for other digital applications that require the moderate transfer rates normally employed in lower cost systems.

SPECIAL FEATURES OF THE TM-7200 PROVIDE A NEW STANDARD OF EXCELLENCE

■ Shared Systems

The electronics (TM-7212) may be time-shared by up to 4 tape transports... for economical and reliable computer tape memory operation.

■ IBM Compatibility

TM-7200 systems provide compatibility and interchangeability with IBM computer formats.

■ Complete Tape Memory System

Integrated tape memory system design allows user more extensive overall system development. The TM-7211 integrates a single transport and Data Electronics/Logical Control Unit. The TM-7212 integrates Data Electronic/Logical Control Unit and Shared Interface for operation of up to four transports.

■ Advanced Transport Control

Logical Control Unit allows efficient and complete control of the tape memory system.

■ Automatic Condition Check

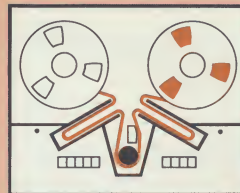
Solid-state circuitry sends condition signals to customer equipment, enabling a data processor to check and verify the status of the tape transport at all times.

■ Compact, Flexible Packaging Concepts

TM-7200 systems can be mounted in any standard 19-inch rack arrangement, or in the completely new TM-7200 console. These new consoles provide the easiest operator access plus extreme compactness. The TM-7212 System in a compact console cabinet (not shown) measures only 54" high, 56" wide and 32" deep.

APPLICATIONS FOR AMPEX TM-7200 TAPE MEMORY SYSTEM

The Ampex TM-7200 Tape Memory Systems are designed to write, read and check digital data in IBM computer formats on magnetic tape—with bit densities of 200, 556 and 800 bpi. The systems provide the user with an extremely flexible, self-contained storage facility for use in a wide range



TM-7211 IN THE COMPACT CONSOLE CABINET
HEIGHT 42", WIDTH 22", DEPTH 28"

of computing control, data acquisition and processing systems. The ultimate of ease in operation and compactness is attained when mounted in the special TM-7200 console cabinets.

TM-7200 SYSTEMS CONFIGURATIONS

- | | |
|---------|---|
| TM-7211 | TM-7 Tape Transport
Data Electronics (Read/Write)
Logical Control Unit |
| TM-7212 | TM-7 Tape Transport
Data Electronics (Read/Write)
Logical Control Unit
Shared Interface (4 Transports) |

DATA ELECTRONICS AND INTERFACE UNIT

The tape transport with data electronics and logical control unit comprise a single system (TM-7211). All data and logical control signals are transferred through the input/output panel directly to the processor. The addition of four transports (TM-7212) gives shared system capability with all data and control signals handled through the tape memory unit.

The tape memory unit includes the following circuits: detection circuits, skew register, strobe generator and output circuits. Optional features of the interface unit are vertical parity check, rate check and write echo check. The local data electronics (read/write) unit contains the following circuits: write head deskew, NRZ register, write head drivers, read preamplifiers and read head deskew.

In the data electronics, data lines are fed via level converters into the write input gates. A write strobe pulse, generated by customer equipment, strobes the data at the input gate to allow entry of the data. The strobed data triggers one-shot delays which compensate for static skew due to head mechanical tolerances.

Data is stored by non-return-to-zero recording. The delayed outputs drive the NRZ register—which in turn controls the write head drivers. A flux change is applied to the tape when a binary one is to be recorded; no flux change occurs when a binary zero is recorded. The NRZ register is reset for the longitudinal parity check by a "write reset pulse," provided by customer equipment. The write driver power supply is gated with the write permit gate.

Skew corrected read head outputs from the local data electronics (read/write) unit are fed to linear differential amplifiers prior to peak detection. The peak detectors have different clipping levels for the write check and read operations. A higher clipping level is used during the write check operation to overcome the effect of the write-to-read crosstalk and to ensure sufficient amplitude for clipping at a lower level on subsequent reading.

The detected read information enters a skew register. A strobe pulse, derived from the first arriving bit of each character, gates the information out from the interface unit and resets the skew register. The strobe pulse is delayed an interval of one-half frame during the read operation—but is advanced during the write check to establish a more stringent check.

A vertical check (optional) is performed on the output of the skew register. An *odd/even parity select* line is available to the parity form generated in the customer's equipment. Skew correction, peak detection and parity check are performed by the data electronics in unshared systems (TM-7211).

LOGICAL CONTROL UNITS

The TM-7200 logical controls are designed to accept tape input control signals, to provide output control signals and to acknowledge signals to the customer's equipment. All required tape command interlocks are provided by the Logical Control Unit to ensure that erroneous command sequences will not cause tape damage or any other system malfunction. The unit also includes the logic for Rewind to Load Point, File Protect and other computer oriented functions. An Operator Control Panel is supplied with the unit for local operation and indicators. Indicators show the status of the system under both *local* and *remote* command conditions. *Operator Control Panel(s)* functions and indicators are:

POWER SWITCH AND INDICATOR

In the "on" position, the transport and its control logic is activated. In the "off" position, the transport and its control logic is deactivated and all power to the transport is off.

REMOTE SWITCH AND INDICATOR

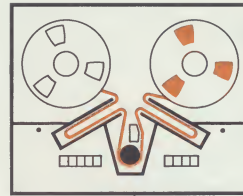
When this momentary switch is depressed, the remote indicator lights up "white." When in remote, if select to the transport is true, the remote indicator lights up "red." When in remote and when select is true, all input and output lines to the transport are enabled, the local state is reset and the local indicator is turned off.

LOCAL SWITCH AND INDICATOR

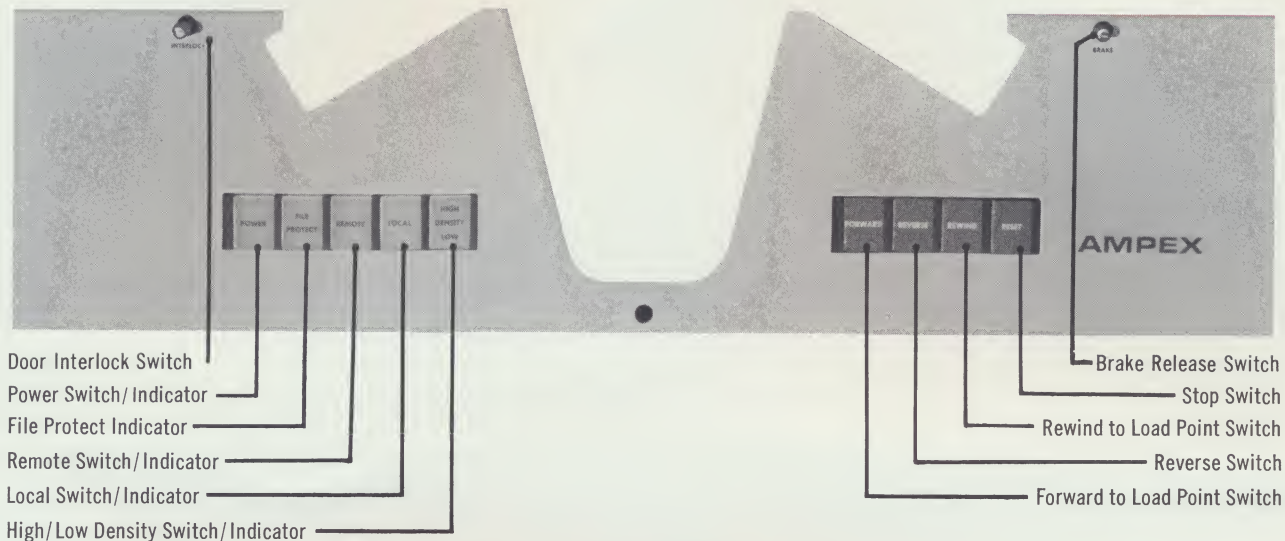
When this momentary switch is depressed (and the "transport ready" is true), the transport is conditioned to accept control commands generated by the local switches only. The remote state is reset and remote indicator turned off. When power is first applied, or "transport ready" is false, the transport is automatically set to the local state.

FORWARD TO LOAD POINT SWITCH

This momentary switch is used in normal operation when a new file reel is mounted. When the switch is depressed, tape is automatically loaded into the vacuum chambers, driven in the forward direction and stopped automatically at the load point. If the tape is already loaded and the switch is then depressed, the tape will be driven in the forward direction. This switch is enabled only in the local state.



TM-7200



TM-7211 OPERATOR CONTROL PANEL

STOP SWITCH

When this momentary contact switch is depressed, the tape is unconditionally stopped, and the transport set to local state.

REVERSE SWITCH

When this momentary contact switch is depressed, the tape is driven in the reverse direction and stops automatically at the load point. If the tape is at the load point and the switch is depressed, the tape is driven in the reverse direction to the physical beginning of the tape.

REWIND TO LOAD POINT SWITCH

When this momentary switch is depressed, the tape is driven at rewind speed in the reverse direction until it stops automatically at the load point. If the tape is at the load point and the switch is depressed, the command is ignored. This switch is enabled only in the local state.

HIGH/LOW DENSITY SWITCH AND INDICATOR

This switch selects the density mode; provisions are made to indicate the mode selected.

FILE PROTECT INDICATOR

When this indicator is illuminated, no writing is permitted on the tape unit. It is on when: a) no file is mounted, or b) a file reel is mounted which does not have a write enable ring.

DATA AND LOGICAL CONTROL ELECTRONICS

STANDARD INPUT AND OUTPUT LEVELS

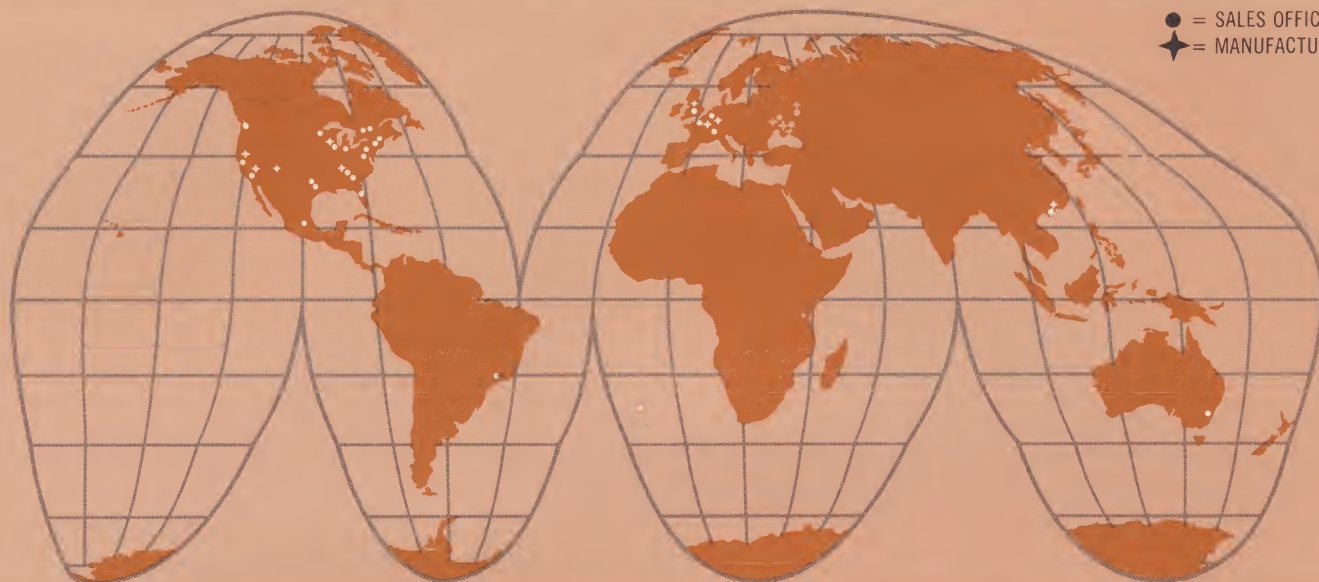
	FALSE	TRUE
Input Voltage Levels (For Data and Control Inputs)	$0 \pm 1.25 \text{ v}$	$-12 \pm 2.0 \text{ v}$
Output Voltage Levels	$0 \pm 1.25 \text{ v}$	$-12 \pm 2.0 \text{ v}$
Output Current Levels	5 ma minimum from the load	5 ma minimum to the load

Input Impedance: 2000 ohms nominal, 3000 ohms maximum

INPUT POWER REQUIREMENTS

Voltage	115 or 230 VAC nominal, incrementally tapped
Frequency	48 to 63 cps at 115 VAC nominal
Current (Unshared System)	Standby, 6 amps; Operating, 10 amps

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